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SQUARE WAVES IN TV TESTING

The excellence of square waves for quickly testing audio amplifier response would seem to recommend them also for use in checking and adjusting video amplifiers. The square wave method is indeed as useful in video as in audio testing and should be employed whenever the necessary instruments are available to the service technician. The video square wave test is particularly useful when a test pattern is not available or when there is some doubt as to correct interpretation of a test pattern or a complete picture.

Time-delay error (phase distortion), as well as amplitude-vs-frequency response is appraised by the square wave test. A good square wave of frequency f usually is assumed to check the response of a system under test from 0.1 f to 10 f. Thus, two square-wave frequencies (100 cycles and 10 kc.) would afford an audio test range extending from 10 cycles to 100 kc. But the harmonics in the frequency spectrum of the square wave are odd-numbered:

$$y = 4E/\pi \ (\cos x - 1/3 \cos 3x + 1/5 \cos 5x - 1/7 \cos 7x \ldots).$$

For this reason, it is often an increased refinement to have several square-wave test frequencies ready for use.

A video amplifier essentially is a good amplifier having wide frequency response, usually to 3 or 4 megacycles. From this fact and the foregoing discussion we might expect that square-wave test frequencies of 50 (or 100), 1000, and 10,000 cycles, 100 and 400 kc. would check a video amplifier completely.

At one time, it was unwise even to consider testing a video amplifier with square waves because oscilloscopes afforded by the service technician could not possibly reproduce a square wave at a frequency anywhere near the high value required to check the upper end of the response. Service-type oscilloscopes capable of reproducing a 500-kc. square wave rather well are now available. However, wide-range square-wave generators are not so easily come by outside of expensively-equipped research laboratories. The best service-type generators do not deliver a satisfactory square wave beyond about 100 kc., and most of the combination sine-square generators do not even reach that frequency. We will show in this article, the circuit of a suitable, inexpensive square-wave generator, the design of which is due to another source.

Test Conditions

A video amplifier under test should have its normal load, the actual picture tube circuit. Sync separator, d. c. restorer, and sync phase inverter circuitry should be left intact. A good point for injection of the square-wave signal is at the output electrode of the video detector tube (See Figure 1), since the detector output circuit usually is the first point of appearance of the peaking components. The square-wave generator should be connected to the detector with the shortest possible length of low-capacitance cable to prevent shunting of the higher-order harmonics of the square wave. The stages ahead of the video detector should be disabled during the test. This can be accomplished easily in sets having conventional parallel-wired filaments simply by lifting the last i. f. amplifier tube.

If the square-wave generator does not have a blocking capacitor in its output, an external capacitor will have to be inserted, as shown by the dotted symbol in Figure 1, to prevent grounding of the video detector. A capacitance of about 0.1 ufd. (preferably a non-inductive capacitor) usually will suffice. The generator should be grounded solidly to the chassis of the TV receiver, and the oscilloscope

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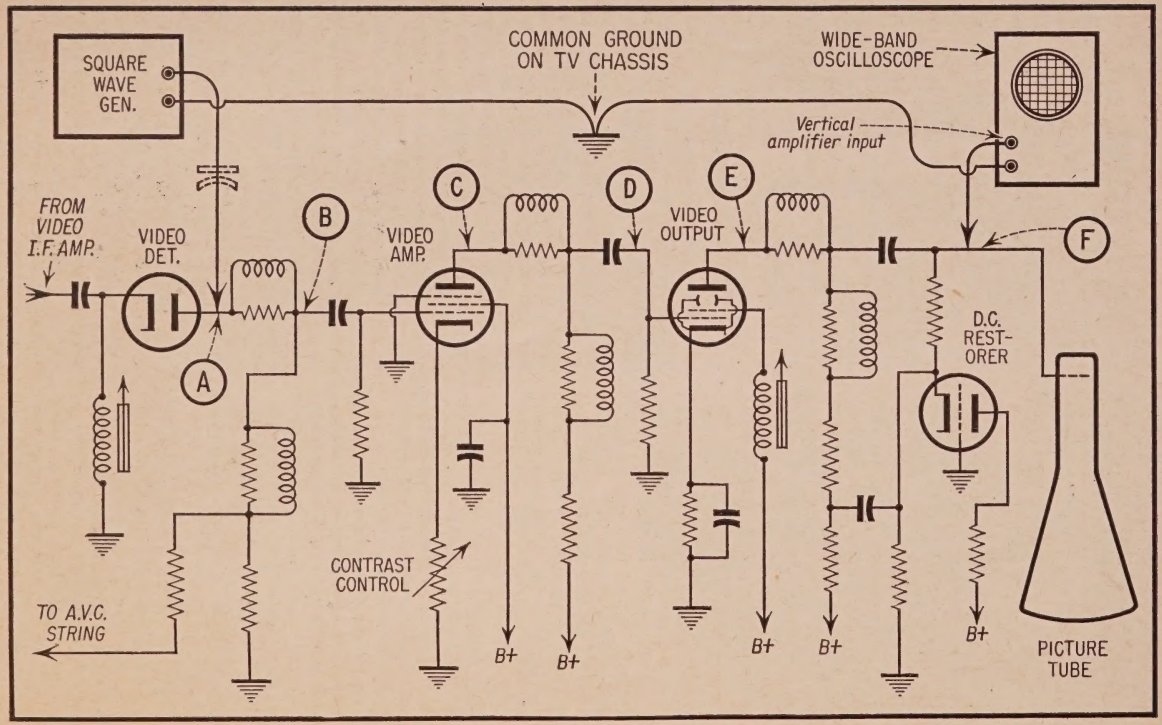
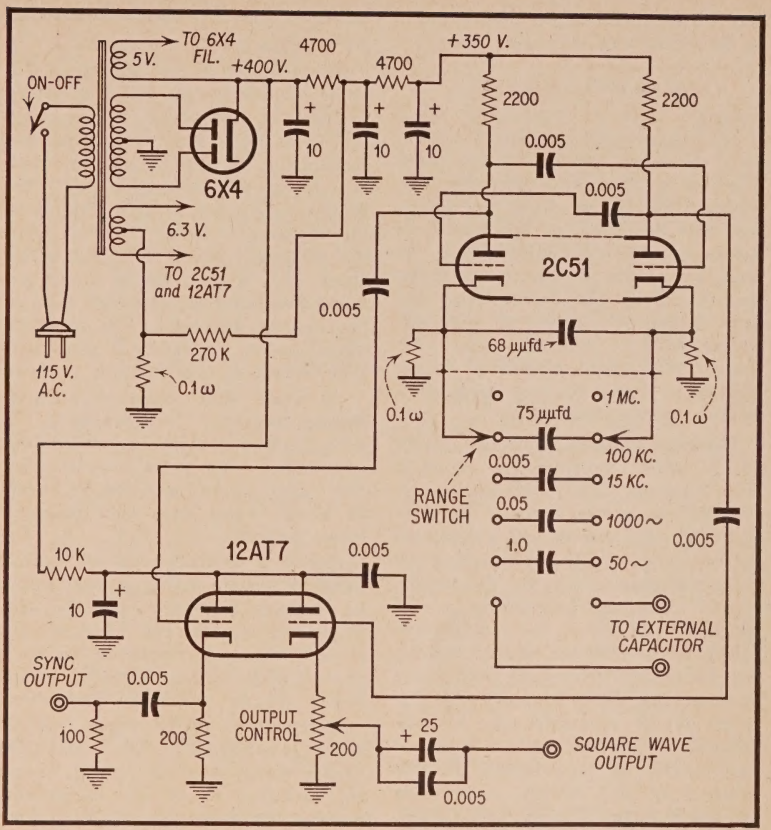


Fig. 1. Video Amplifier, with Test Points.



From "Inexpensive Square-Wave Generator," G. W. Gray, ELECTRONICS, Feb., 1952.
Fig. 2. Wide-Range Square-Wave Generator.

should be grounded to the same point. Immediately after connection of the generator to the detector, the waveform should be inspected **at the point of signal application.** This is done to determine if the waveform squareness is affected by the combination of generator blocking capacitance and detector-circuit resistance. If the squareness is degraded, the blocking capacitance must be changed to a more favorable value.

The oscilloscope must be connected to the circuit also through the shortest possible length of low-capacitance cable (or simply two short well-separated leads), in order to minimize shunting of the high-frequency components of the square wave. An oscilloscope probe may be used only when prior tests have shown that the probe will not distort the highest-frequency square wave which will be used in the test. Both scope and generator

must be grounded to one chassis point in the video amplifier area.

Square-Wave Generator

Figure 2 shows the circuit of a wide-range, step-frequency-type square-wave generator satisfactory for video amplifier testing. This generator was designed by G. W. Gray of R.C.A. and was described in his article in February, 1952, ELECTRONICS. A duplicate of this instrument has been constructed by the Editors and has been found to deliver an excellent square wave up to 1 megacycle. We present this circuit because it is the best we have seen for easy duplication by the service technician.

The circuit is a unique employment of a 2C51 multivibrator without grid resistors. The multivibrator is "loaded" by a dual cathode follower (12AT7), one side of which furnishes the square-wave output signal, and the other side sync voltage for the oscilloscope. Operating frequencies are selected by means of the double-pole rotary selector switch which connects the frequency-determining capacitors between the 2C51 cathodes. A different set of capacitors may be employed, if desired, for a different combination of frequencies. In one position of this switch, connections are made to the EXTERNAL CAPACITOR terminal posts for connection of a single frequency-determining capacitor.

Tests and Indications

The first test should be applied to the entire amplifier; that is, with the generator and scope connected to the typical input and output points, as shown in Figure 1. Subsequent tests, if required, can be made on individual stages. In most cases, however, the overall test will reveal any troubles present, and the effect of remedial measures may be observed with the same setup.

The internal sweep of the oscilloscope should be set for a minimum number of stationary square-wave cycles on the screen. This gives best readability. At low frequencies, there will be no trouble adjusting for one of two cycles, but at high frequencies the minimum number depends upon the maximum sweep frequency of the scope. For a good steady image, the scope should be synchronized with the square-wave generator. The generator circuit shown in Figure 3 supplies a sync output voltage for this purpose.

At least four check frequencies should be used. In most cases, 50 cycles, 1000 cycles, 20 kc., and 300 kc. will suffice. But for a complete test; 500 cycles, 10 kc., and 400 kc. might be added when time and generator range permit.

Figure 3 shows a set of typical distorted square waves as they might be observed in a video amplifier test. These waveforms are idealized for clear presentation but have the same general shape as those observed on the screen for the conditions indicated.

Interpretation of the output "square" waves is substantially the same as for square waves in audio testing, except for identification of the components causing the distortion. Leading low-frequency phase shift, for example, of the type revealed by Figure 3(b) can cause gradual changing of picture shading vertically on the screen. Coupling and bypass capacitors and low-frequency compensation usually are at fault. The opposite condition of lagging low-frequency phase shift (Figure 3c) can cause the same type of picture disturbance but generally is the result of overcompensation in the amplifier.

Square-wave patterns, like Figure 3(d), which indicate poor high-fre-

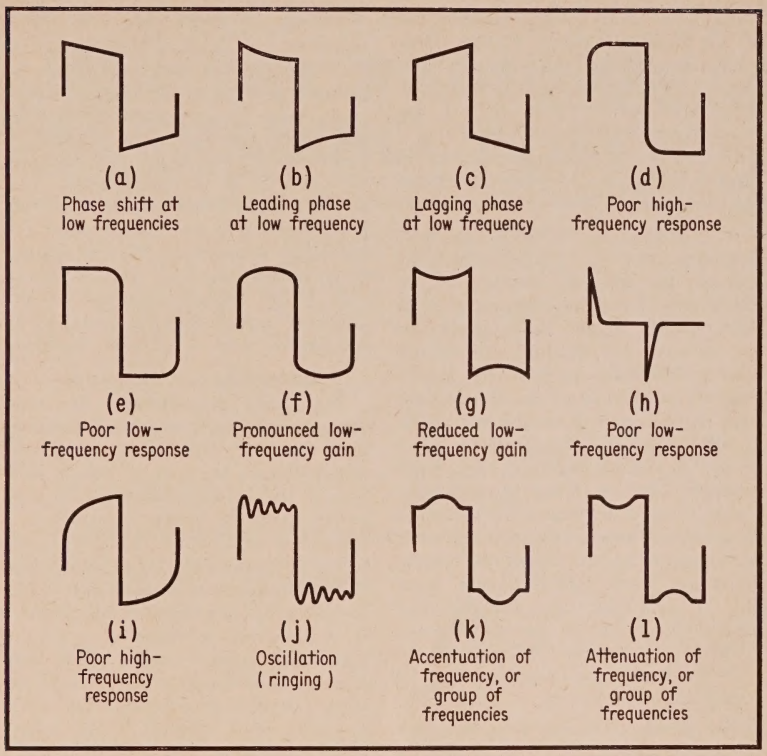


Fig. 3. Distorted Square Waveforms.

quency response, go hand-in-hand with poor picture detail and fuzzing. Trouble generally is in the peaking coils, excessive plate load resistance (careless replacement), or stray capacitances due to disturbed lead dress. The condition is aggravated to a great extent when the high-frequency response is glaringly bad, as indicated by the pattern of Figure 3(i).

The oscillating top and bottom in Figure 3(j) are due to ringing in the circuit. Oscillation stripes will appear on the picture screen. Here, a damping resistor shunting a peaking coil probably is open, the circuit has been overcompensated, or high-frequency roll-off is too severe.

A good rule of the thumb for rapid decision as to the effect upon the picture of a condition indicated by square wave distortion is: poor low-frequency response means a smeared picture or gradual change in shading from top to bottom of the screen. Poor high-frequency response means loss of detail. Excessive high-frequency response usually results in oscillation stripes or bars or in sharp shading

changes, or both. Horizontal tilting of the square usually results from fundamental-frequency phase shift. Horizontal curvature generally means that the amplifier gain is not flat to the fundamental frequency. Vertical leaning and exponential rounding of corners (Figures 3d and 3i) reveal high-frequency deficiencies.

It is important to make the low-frequency test at a frequency low enough to appraise accurately the video response at the lowest end of the amplifier range. There should be no attempt, for example, to escape with use of 1000 cycles as the lowest square-wave frequency on the assumption that it will give a good check at 100 cycles. A 50-cycle square wave should be used. Similarly, the high-frequency square wave should have a fundamental frequency high enough to give a reliable indication of what is happening at the top of the amplifier range. But this frequency must not be so high that its principal harmonics are apt to be out of range of the video system. In general, the high-frequency fundamental should be kept below 500 kc.

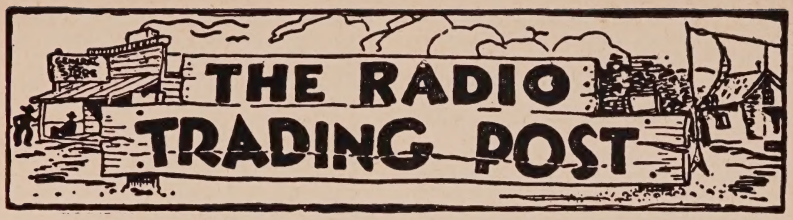
The square-wave test is particularly useful in showing up the degrading of high-frequency response when lead dress has been disturbed during replacement of components in the video amplifier. Many technicians do not appreciate the importance of lead dress in this circuit. Often, a slightly different length of pigtail on a new damping resistor or peaking coil will so alter the circuit stray capacitances as to reduce the high-frequency response. The effect may be observed readily as high frequency deformation of the square wave. In fact, where high-frequency response is noticed to be disturbed after a replacement, the square-wave pattern may be monitored while re-positioning the components (bending, twisting, etc.) for better response.

Where the contrast control is the cathode resistor of a video amplifier stage, as in Figure 1, independent tests should be made at the selection of square-wave frequencies with the contrast control at various settings. This is advisable because this type of control alters the tube capacitance and thus the capacitance in the range-determining system of the video circuit. The overall response of the amplifier cannot be the same at all settings of such a cathode resistor.

Advantages and Limitations

We make no attempt to offer square-wave testing of video amplifiers as a cure-all. There is some natural opposition on the part of service technicians to all tests and measurements which have any of the earmarks of a laboratory procedure. This test does tell with remarkable speed when there is trouble in the video amplifier. And trouble often is present in this channel to destroy the crispness of a picture even when other channels are scrupulously adjusted. You can follow the effectiveness of your adjustments while watching what happens to the square wave with better certainty than while watching the gross and moving picture on the TV screen.

On the disadvantage side of the ledger, however, is the fact that another test instrument — the square-wave generator — is required. But this generator is not without other usefulness. It can be used to test audio systems, as well, and if the operator is in hi-fi servicing and installation, as well as TV, he will get his money's worth out of it. Also a possible disadvantage is the fact of time taken by the test. We feel, however, that the certainty afforded by the test justifies the time it takes to make it.



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SELL OR TRADE — Webster-Chicago record changer, 10", 12", 78 RPM, with crystal cutting head disc recorder mechanism added; National HRO, Jr., repainted metallic gunmetal blue. A. Glozer, Jr., 1630 South Cuyler Avenue, Berwyn, Ill.

FOR SALE — Like new 800 w. transmitter, completely enclosed in 7' high relay rack and DE-TVI'd, phone and CW operation on 10, 15, 20, 40, 80 meter bands, external VFO included. Weight 800 lbs. Harvey L. Pastan, 47 Shaw Rd., Brookline, Mass.

FOR SALE — NRI radio-TV FM amateur course with parts, best offer. Salerni, 223 South Winebiddle Ave., Pittsburgh 24, Pa.

WANTED — 16 mm. sound films. Will buy or trade for tubes, test equip., etc. F. Tantillo, 17 Orange St., Abington, Mass.

SELL OR TRADE — Back issues: Service; Radio - TV Service - Dealer; Radio - TV Maintenance; Communications; Radio-Electronics magazines. Trade for early battery radios. Send for list and prices. Harold Garrett, 711 South New York, Sedalia, Mo.

FOR SALE — Hickok 640 laboratory 5" scope;Hickok 610A sig. gen.; Precision 10-12P tube tester. Cash only. Joe Tucker, 866 East 48th St., Brooklyn 3, N. Y.

FOR SALE — Eico and Heathkit sweep gen., need calibrating, $30 each; back issue magazines: 50 each of Popular Science, Service, and Radio Service Dealer, $5; Popular Mechanics, $6, all FOB. T. Wojciechowski, 2837 Fulton St., Brooklyn 7, N. Y.

FOR SALE — 3-speed record changer, $13.95; LP record player, $3.95; tape recorder with six 7" reels tape, $49.95; rear loaded corner horn for 8" and 12" speakers, $9.95; with speakers, $14.95. J. C. Davis, 9014 North Laramie Ave., Skokie, Ill.

FOR SALE — VTVM Eico 221-K, perf. cond., calibrated against standard, with test leads and booklet, $23. E. G. Fleenor, 4913 Grand Ave., Des Moines 12, Iowa.

FOR SALE — Zenith overseas 3-way portable receiver, standard and shortwave broadcast, operating but needs some work, $22.50; Dynamotor, PE-103, l. n., with cables and base, $19.50 FOB exp. collect. $5 deposit with order. Vernon Esgar, 64 Longview Ave., San Anselmo, Calif.

SWAP — Model 2405 Triplett volt-ohm-milliammeter, perf. cond., guaranteed, for scope, size not important, but in good working cond. Robert O'Neil, Townline Rd., RD 3, Ithaca, N. Y.

FOR SALE — Tubes and parts for TV and radio; Mallory TV-101 converter, l. n., 6 for $140. Quitting business, send for list, lots of bargains. Fred's TV Sales and Service, Box 56, Denver, Pa.

FOR SALE — Riders TV manuals, l. n., 1 thru 9, $12 ea.; Sears Roebuck 12" jig-saw, l. n., tools and TV equip. Local. Al Malakoff, 63 - 36 108th St., Forest Hills, N. Y.

WANTED — Sig. generator: Jackson 641 or Triplett 3433 or Hickok 288X or Hickok 191X with blue case. Advise exact cond. and lowest price including shipping. Robert S. Miner, Box 52, Elmwood, Conn.

WANTED — Plug-in antenna padding condensers for Meissner 150B transmitter C211, C212, C213, complete with plugs; also 10-meter ground plane antenna. George W. Brooks, 18 Country Way, Greenbush, Mass.

FOR SALE — 10 coin-operated radios with night-stand tables attached for use in hotel or motel, all in good cond. Best offer over $280. J. O. Turner, Box 37, Homer, La.

SELL OR TRADE — Scott all-wave 15, 550 Kc. to 18 Mc.; BC 654 and 659 with 6 v. power supplys; BC 1068A, 684 FM and 603 receivers. C. G. Hoffman, Box 186, North Terre Haute, Ind.

SELL OR SWAP — Model 550X Hickok tube checker and Cine Kodak, f1.9 mag. load with case, for 17" or 21" TV, or what have you? Atlantic Radio, Atlantic, N. C.

WANTED — Cash for Smith's Advanced Communication Engineering course, Nilson Master course, or CREI Advanced Radio Engineering; Practical TV Engineering or Advanced Math course. S. E. Anderson, NAVAIDS Div., Hq. AACS, Andrews AFB, Washington 25, D. C.

WANTED — Radio and TV serviceman to operate repair shop on 50-50 basis, full partnership in established business to right party, no capital need be invested. Brown's Radio and TV Service, 107 East Main St., Morganfield, Ky.

FOR SALE — Hi-Fi equip., including Altec speakers; Fisher audio control, tuner and amp.; Thorens turntable, Electro Voice mike; Revere tape recorder. All in perf. cond. Philip Lance, Greenwich, N. J.

WANTED — Tech manual for AN/ART-13 aircraft equip. Will pay cash. Norman Wehrli, Box 1247, Kilgore, Texas.

FOR SALE — GE transmitter, 150 w. input, unused and same for 1,000 v. power supply, 7 tuning units covering 200 to 500 and 1,500 to 12,500 Kc., with tubes, cables, and instruction manual. L. C. Chapman, Fairhope, Ala.

FOR SALE — Authorized reconditioned Hallicrafter SX28, B.R. speaker, $110; never used Dumont 274 scope with extra 5BP1 tube, $50. Ed. Kane, Soldiers Home, Quincy, Ill.

FOR SALE — Teletype machine model 26 sending and receiving complete, also ¾ Kw. Delco gasoline 32 v. gen., semi-portable. A. P. Moritz, 174 Harrison Ave., Montclair, N. J.

FOR SALE — Complete 80 meter mobile station, $125. For details contact: F. A. Criswell, Box 362, Childersburg, Ala.

SWAP — Simpson 303 VTVM and 260 VOM, both exc. cond., for late mutual conductance tubechecker. Trade 600 popular receiving tubes (retail value, $2,000, guaranteed for six months), for air conditioner, outboard motor, test gear, or what have you? Herbert Piller, 749 Beck St., Bronx 55, N. Y.

FOR SALE — Harvey-Wells TBS50A comp. with speech amp., tubes, $75; model 12 Teletypewriter, $50; GI 78 RPM disc recorder with crystal head and playback, $15. All exc. cond. Want KW gas generator. Andrew G. Stavros, 116 - 32 132nd St., South Ozone Park 20, N. Y.

FOR SALE — HT-9 Hallicrafters transmitter, with coils for 80-40-20-10, and extra 814 tube for final, good cond., $150; Lysco "600" 30 w. VFO transmitter, bandswitched for 80-40-20-15-10, de-TVI'd, with built-in low pass filter, l. n., $90 FOB. R. W. Goetsch, 929 South 7th Ave., Wausau, Wis.

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WANTED — Radios and parts, radio books, catalogs, magazines, wiring diagrams, for old home built sets. Wilbur E. Peatfield, 307 Saratoga St., East Boston 28, Mass.

SELL OR TRADE — Jackson 655 audio oscillator, Transvision TV field strength meter AC and battery, MN-26 receiver, complete, Command radio equip., tubes: 211, 807, 811, 813, 815, 826, 832, misc. meters. Want tape recorder. Scott Janikula, 16061 21st Ave. SW, Seattle 66, Wash.

SELL — Crystal calibrators, used in ATC model ART-13, require two 12 SJ7 tubes and 200 Kc. crystal, $3.95; Boehme automatic keyer with McElroy 3-key tape perforator for Morse Code, $145. Tom Howard, 46 Mt. Vernon St., Boston 8, Mass.

FOR SALE — 200 w. mobile transmitter Collins ART/13, 813 final, 811 modulators, automatic tuning on 80-40-20-10, includes generator run from fan belt, complete 28 v. regulated system, dynamotor, batteries, cables, remote control, manual, $175 plus shipping. King, 200 Midland Rd., Springfield, Pa.

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FOR SALE — NRI sig. tracer, never used, $40; assorted tubes and parts, write for list. Ernest Beard, 6007 South Wood St., Chicago 36, Ill.

FOR SALE — Hallicrafter S-29 receiver, BC to 30 mc., 4 bands, 8 1½ v. tubes, 110 v. AC, DC or mobile, needs work, $25; oscilloscope, Waterman 11A, 3" Industrian and Television, l. n., $69. A. C. Livingstone, 12-01 Ellis Ave., Fair Lawn, N. J.

SELL OR TRADE — Supreme 504A tube and set tester combination, complete with test leads, instruction book, $40 or good Gonset Super 6 converter, ham gear. Eddie Gigliotti, 249 So. Main St., Bangor, Pa.

SWAP — St. George wire recorder mechanism; Turner model TVI and antenna top TV booster; 400C Craftsman Hi-Fi amplifier. Make offer. Milo Adamson, 4060 South Penn., Englewood, Colo.

TRADE — 550 stamps and album plus cash for S-38 receiver. Vernon Hoskinson, Prescott, Iowa.

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SWAP — Cushman motor scooter (value $150), and RCA tape recorder, l. n., (value $189). Want National or Hallicrafter receiver or Xmtr. John Glawe, 36 Irving St., Wilkes-Barre, Pa.

FOR SALE — Heathkit sig. tracer, model T-1, hardly used; "Modern Radio Servicing" by Ghirardi. Both $18, or best cash offer. Harry Steinberg, 2200 Tiebout Ave., New York 57, N. Y.

TRADE — Hallicrafters SX25 with matching speaker in exc. cond., for 8 mm. movie projector or tape recorder. Marstan TV Co., 13 Marcy Pl., Bronx, N. Y.

SWAP — Receiving tubes, speakers, I. F. transformers, vibrators, 3-range AC volt meter (mirror scale) in carrying case; Meissner ex-signal shifter and FM modulator, plug-in coils; for good TVied Viking I or II, with VFO, or Viking Ranger. Don Jensen, 3529 Dunn Ave., Cheyenne, Wyo.

WANTED — National 40 w. multi-band MB-40-L turret. Have some 813's, AC meters, handset with push-to-talk switch, dynamotor, 40 HV mica condensers, etc. to swap. J. E. Struthers, Box 112, Morrisonville, N. Y.

WANTED — Pictorial diagram or schematic for Radiola X. Edmund Liles, 433 Mass. Ave., Norfolk 8, Va.

FOR SALE — Heathkit scope 0-6, aligned with Dumont scope, $50; Heathkit sig. gen. SG-6, aligned with General Radio sig. gen., $35; 12½" Transvision in cabinet, $25; with instruction manuals. Will not ship. William Henshaw, 46 Front St., Tarrytown, N. Y.

SELL OR SWAP — Kohler light plant, 800 w., 115 v., 60 cycles, 1 phase, l. n., $175, or exchange for radio service parts, manuals, testers. W. K. Fralick, Route 1, Marion, Ky.

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WANTED — U. S. and foreign stamps, mint or used. Will swap surplus radio gear, Radio News, photographic magazines. B. Roka, 5341 Cordelia Ave., Baltimore 15, Md.

FOR SALE — Sun CR-10 triode amplifier, $40; Collins FM-11 tuner, $35; Tele-Tone AM-FM 8-tube table radio, $25; RCA-Victor 45EY2 phonograph, $25; GE LB-530 portable radio, $25; FOB. Ted Hein, 418 Gregory, Rockford, Ill.

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FOR SALE — Harvey-Wells Xmtr. TBS50C with complete change of tubes, three crystals (2-80 meters, 1-40 meters), power supply APS50, Hallicrafter S38C, exc. cond., $115. FOB. E. C. Porter, 19 Penniman Terr., Braintree, Mass.

FOR SALE — Heathkit vibrator tester, $12; Stancor Deluxe 110 v. AC - 6 v. DC pack, $20; Hickok 505 scope, $100; Du-Mont 224A scope and probe, $175. Paul Wunsch, Jr., 421 Clifton Ave., Clifton, N. J.

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FOR SALE — National NC-125 receiver, like new, with S-meter, noise limiter and other features. Best offer ever, $155. J. P. McCullen, 3050 Bainbridge Ave., Bronx 67, N. Y.

SELL OR TRADE — BC654-A with PE103-A power unit, 3700 Kc., to 5800 Kc., $49.95; Army gun camera type N6, 16 mm., $12.95, or what have you in professional tape or disc recording apparatus? R. Clement, Chester Springs, Pa.

TRADE OR SELL — 5" partially converted scope, originally gun director scope; radio tubes; 3" Triplett volt-ohmmeter; analyzer, in case; RME84 radio receiver. Would like TV test equip., larger communication receiver. Raymond Wingfield, Box 172, Lake Bluff, Ill.

WANTED — Cheap inter-comm set in fair cond. Name your price. J. R. Kendall, Buffalo, Mo.

WANTED — RA 34 rectifier and power supply. J. P. Hyde, Box 242, Manassas, Va.

SELL OR SWAP — PE103, exc. cond., guaranteed, with base and cables, for photo equip. Wallace Printz, 1177 East 14th St., Brooklyn 30, N. Y.

FOR SALE — Riders radio manuals 1-11 inclusive, good cond., $45, plus shipping charges. Stephen Kalista, 3423 North Hope St., Philadelphia 40, Pa.

SELL OR TRADE — NRI radio and TV course, $10. Need 6 ft. relay rack open or enclosed. George J. Markowitz, 64 Worth Ave., Hudson, N. Y.

WANT — Rider Chanalyst or equivalent, tunable sig. tracer. State cond. and price. Roy C. Ragan, 4213 Washington Blvd., Chicago 24, Ill.

SWAP — Like new S53A for S-36A,, or good high freq. receiver. Chas. Fernandez, 81 Warren St., Roxbury 19, Mass.

SELL OR TRADE — Recording King super auditorium size guitar and case, carved top; prewar DeForest course; Rider record changer manual. Want electric steel guitar less amplifier. Heath Q meter. D. C. Harrington, 2508-B 36th St., Los Alamos, N. Mex.

SELL OR SWAP — NC-100A receiver, $65, plus freight charges, or HRO receiver (early model, senior, etc.). Will pay $30 cash difference. N. S. Nahman, 1918½ North Glebe Rd., Arlington, Va.

WANTED — Marine Radiotelephone 25 w. or more with or without Xtals for cash or will trade photo equip. Northport Camera Shop, 229 Main St., Northport, N. Y.

SELL OR SWAP — Meissner 78 RPM recorder-phono, used but electrically and mechanicaly perf., $30; 8 mm. projector, hi-power binoculars, or hunting rifle. Howard Gross, 727 E. 10th St., Brooklyn 30, N. Y.

WANTED — Binocular wide-field microscope. Have Presto K-8 recorder, Meissner analyst. Neal F. Page, 5924 Fairfax Ave., Minneapolis 10, Minn.

FOR SALE — UHF converters: Mallory, $25; Sutco, $20; old projection type chassis only with tube and lens, $50 FOB. T. V. Service Co., 96 Egbert Rd., Bedford, Ohio.

FOR SALE — Heathkit 09 scope, $59.50; Heath VC-2 voltage calibrator, $9.50, both in perf. cond. Paul Richter, 1446 Webster Ave., Bronx 56, N. Y.

WANTED TO BUY — Vol. XIV, Nos. 1 and 2, March, June, 1953, issues of "RCA Review." Donald Ringler, 100 Irvington Street, S.W., Washington 24, D. C.

FOR SALE — Kirby fly-back tester model 98, still in warranty and in original carton. C. Soest, 12092 Kilbourn, Detroit 13, Mich.

WANTED — Back issues of "Audio Engineering," 1948 to present. State price and dates. S. Consalvo, 4905 Roanne Drive, Washington 21, D. C.

SELL OR TRADE — Alliance antenna rotor, rec tubes, tele parts, for 8 mm. projector. Ted Wasek, 106 Beech St., Rutherford, N. J.

FOR SALE — Heathkit comm. receiver, AR-2 with cabinet, best offer. Arnold Moskowitz, 213 - 02 75th Ave., Bayside 64, N. Y.

FOR SALE — ATR inverter, 12 v. DC input, 110 v. AC output at 125 w., exc. cond., sacrifice. Sidney Finley, Jr., 7411 East Marshall, South San Gabriel, Calif.

WANTED — RCA AVT-112 Xmitter in good cond. for cash. C. M. Schentes, ET2, S .S. C. Staff "RM" "A" School, NTC, Bainbridge, Md.

SWAP — Westinghouse schematic and service notes (TV) for twenty Raleigh "903" coupons. Selcraft, Box 394, Spring Valley, N. Y.

SELL OR SWAP — Cinemaster 8 mm. movie camera, telephoto lens, sunshade, filters, metal tripod. Want tape recorder, scope, grid dip meter. W. M. McDonald, 60 Rill St., Providence, R. I.

FOR SALE — 60 w. Fone-CW transmitter, complete with power supply, 2E26 modulators, 807 final, 2 type 80 and 5U46 rectifiers, 11 tubes altogether, complete with rack panel for rack mounting, $50. Ronald Basso, 217 Wilson, Ironwood, Mich.

FOR SALE — Back issues: "Radio and TV News," "Radio Electronics," "PF Index," "Service," "Technician," "Radio TV Service Dealer." State copies wanted. Cheri's Radio-Television Service, 1865 15th St., Wyandotte, Mich.

FOR SALE OR TRADE — Instructograph (AC model) with 5 practice tapes, $25 or best offer, or trade for old U. S. coins, radio gear. H. W. Meiss, 1128 Cheyenne Drive, Cincinnati 16, Ohio.

JOB OPEN — for TV technician with car for part time. Paragon TV and Radio Service, 170 - 26 Jamaica Ave, Jamaica 32, L. I., N. Y.

SELL OR TRADE — Alliance tennascope booster, $10, or trade for Heathkit isolation transformer, etc; two tube phono oscillator $5; 12 gauge Higgins (l. n.) 6 shot bolt action shotgun for Heathkit battery eliminator, or equal quality. Robert Harris, 1735 North Gettysburg, Dayton 7, Ohio.

FOR SALE — EMC model 200 transconductance portable tube tester, A-1 cond., $20 postpaid. Charles W. Leigh, 162 Passaic St., Trenton 8, N. J.

TRADE OR SELL — Within 100 mi. of New York City: recorder, books, records, appliances, slide rule, etc. Want test equip., and 60 ft. or larger sailing vessel under $10,000. S. Gross, 17 West 108th St., Shanks Village, Orangeburg, N. Y.

FOR SALE — Unused 813 Xmtr 500 w. CW, 400 w. phone, no TVI, pi-section output, 250 w. modulator with multi-match transformer, 811's, power supplys to drive rig to 200 w. output. Best offer . J. H. Walker, Jr., 27 River Rd., Warwick, Va.

FOR SALE — Ghirardi's Modern Radio Servicing; and Radio Physics course; Rider's Servicing Receivers by Resistance Measurements; Smith's Modern Marine Electricity; and Gould's Training the Local Announcer, l. n. Geo. Rostky, 142 Forsythe St., New York 2, N. Y.

FOR SALE — Heathkit 0-8 scope and demodulator probe, $37.50, Heath sig. gen. SG-6, $15. Both calibrated and in perf. cond. W. D. Silva, Box 411, Monterey, Calif.

FOR SALE — "Everybody's Radio Manual" by Popular Science monthly staff and Audel's "Engineers and Mechanics Guide No. 2." You name price. Rhoda Bornstein, 142 Forsythe St., New York 2, N. Y.

WANTED — To contact someone having schematic on (Scott) Navy surplus set, SLR-12-B. L. Matushefske, 2 Elmont Rd., Elmont, L. I., N. Y.

FOR SALE — BC-453, 454, 455 receivers, BC-457, 459 transmitters, in racks, converted; 12 v. 12-amp Xfmr for fil. volts; components for HV supply of 750 v. 400 Ma. (866-a's); 60 w. modulator (807's PP), needs work. All for $153.50, or write. D. J. Wheeler, 1803 Hawthorne, Independence, Mo.

SWAP — 7" TV receiver for small printing press. R. W. Heckbert, 30 Magoun Ave., Medford 55, Mass.

FOR SALE — VM950 Triomatic, flip cartridge, in original carton, $24.50 prepaid; 8" Quam P.A. "adjustacone" spkr. 6.8 oz. Magnet. 3.2 ohm V.C., $4.75; GE RPX-050 dual sapphire cart., $3.85. L. Brown, 237 South 2nd St., Brooklyn 11, N. Y.

FOR SALE — Four unused (in boxes) UHF converters, two Mallory's 88's; Blonder-Tongue 99; Granco LCU. Best offer accepted. Bud's Radio and Television Service, 5912 Hampton Ave., St. Louis, Mo.

SWAP — 18" jig saw with ¼ HP motor, complete, for tube tester. Local preferred. L. C. Newell, 3287 70th Ave., St. Petersburg, Fla.

FOR SALE — 4-band 14-tube Farnsworth model GK140 Hi-Fi receiver with 12" PM speaker; back issues of Service, Radio Craft, Radio TV Service Dealer magazines. Ed Larson, Route 2, Ostrander, Ohio.

FOR SALE — GE Uni-meter, l. n., all ranges, volts, amps, ohms. Full details given, no trades, $15. Frank E. Wooley, c/o Westinghouse, Meter Division, 1-4 Laboratory, Newark, N. J.

SELL OR TRADE — Stancor 60N transmitter 10 to 80 meters, phone, CW, $100; Motorola 10 meter transmitter T-69-20-A $80; Eico sig. gen., $25. Want Lysco, 20 meter beam, etc. E. B. DeTurck, 841 47th Ave., San Francisco 21, Calif.

SWAP — NRI Radio and TV course with 35 radio repair booklets, for factory wired Eico model 145 sig. tracer. Ray Arendt, 207 East Amherst St., Buffalo 14, N. Y.

WANTED — Philco radio chassis model 37-116, code 122, dial scale, mask and link asst., osc. coil for range 2, must be good, tubes not necessary. State price. L. J. Teator, 512 State St., Hudson, N. Y.

POSITION WANTED — Young man, 18 yrs. old, already completed 32 lessons from NRI Radio and TV Servicing course, wishes position with radio repair shop. For info. write: Sal Isgro, 118 Gamewell St., Hackensack, N. J.

FOR SALE — Three Eimac 4-125A tubes, in original factory cartons, $25 each, shipping prepaid in U. S. Harold Reed, 1347 South Capitol St., Washington 3, D. C.

SELL OR SWAP — Signal Corps BC-455-A receiver, 9-6 Mc. (used), power supply with provisions for BC-454, 456 receivers, $15. Also 12 l. n. issues of Radio and TV News, 1953. Prefer local. William Lindquist, 8 Sumner Ave., Brooklyn 6, N. Y.

FOR SALE — Full workshop of equip.: tube testers, Riders manuals, tools, resistors, service manuals, more than 900 tubes, etc. Seling out. Write for info. H. M. Patton, Oxford, Mich.

WANTED — Tape recorder in good shape, will trade or pay difference of a Hallicrafter S-36. Harry Choy, 1274 Union St., San Francisco, Calif.

FOR SALE — 167BY transmitter 2 to 24 Mcs. Xtal-VFO 813's Pi network final, 200-900 w. TVI'd Pfd commercial power supply. Enclosed in cabinet, recess for receiver with built-on table. Send for photos. J. R. Whitmore, 3019 Broadway, Indianapolis, Ind.

SELL OR TRADE — RCA Service manuals, 1931 - '40, new cond., Navy hand gen., CBF-21263-B 450 v. and 6 v., l. n. Want cash, good flash camera. Carl Price, Jr., Box 37, Minford, Ohio.

FOR SALE — Car radios: 1949-'50 Fords, $25; 1948 Packard $25; Tubes: 5BP4 $1.50, T200 $5, 851 $10, 35T $2, 1616, 6AC7, 6AK5, 65 cents, 450TH $25. C. Choszik, 6028 Larkins, Detroit 10, Mich.

WANTED — Pair of Devry XD-XDC 35 mm. sound projectors without amp. or speaker. A. Pierucci, 345 West 21st St., New York 11, N. Y.

WANTED — Used 152-162 Mc. FM 6 v. DC receivers, transmitters or convertors, mobile. Must be good condition and reasonable. John Marston, Box 333, Hampton, N. H.

FOR SALE — National Select-O-Ject, $15, one year old; also 6-tube Motorola model 701 two years old, exc., $25. Use money order for receipt. L. E. Willis, R. 1, Winchester, Ind.

FOR SALE — Original Jewel wall tube tester modernized by Precision; Supreme radio analyzer, model 401, fine cond.; magazines: Radio Broadcast 1927-31; Radio News 1925-33; Radio Craft 1930-34. Make offer. Bart Radio Service, 81 Lawrence St., Hartford 6, Conn.

FOR SALE — Altec-Lansing 400B Hi-Fi spkr., $16.50; 6" electric power planer (steel stand, 1/3 HP AC motor) $40; 5 Centralab Dual 500K pots, 2½" shaft, $1.50 each, all 5, $7. All above l. n. and plus postage. M. A. Porter, 1709 North Larrabee St., Chicago 14, Ill.

FOR SALE — Unused UHF converters: 5 Motorola TC101 and one Regency, $15 each; pair Vocatron CC2 intercom, l. n., $30. Jack Johnson, Box 56, Delton, Mich.

FOR SALE — 14" Crosley table model TV, new tuner and tubes, A-1 shape, $50, or make offer; one speed 78 RPM automatic record changer, $8. Vernon Kroh, New Salem, N. D.

FOR SALE — Riders manuals, 1-12 incl., $50 for the set. Theo. M. Lewis, 318 South 6th St., Saginaw, Mich.

FOR SALE — 2 table model 5-tube AC-DC standard broadcast radio sets: Airline, 1949, model 94-HA-1527, very good cond., $18; 1948 Emerson, bakelite cabinet, very good cond., $7, shipping charges extra. Samuel T. Chase, 20 Brookside Ave., Somerville, N. J.

WANTED — ¼" electric drill, dynamic mike, TV booster. Will swap misc. new condensers, resistors, U.G. connectors, tubes, switches, crystals, etc. Murray Goldberg, 2652 East 21st St., Brooklyn 35, N. Y.

WANTED — Riders radio manuals, 1 thru current, and Riders and/or Sams TV manuals, 1 thru current issue. State cond. and price. Raymond J. Mercer, Jr., Box 864 Gloversville, N. Y.

SACRIFICE SALE — Hammarlund HQ-129-X receiver with speaker, exc. cond.; transmitter with power supply, 5' rack and panel fully metered, 160 to 2 meters, 829-B final 75 w. phone. Make offer. C. C. Blauvelt, Sr., Fort Montgomery, N. Y.

FOR SALE — R44/ARR5 Hallicrafters AM-FM-CW 27 to 146 Mc. superhet with home brew power supply, $50; 350 v. 100 Ma. (after filter) plate Xfmr., $3; dual 12 henry 100 Ma. choke (two in one casing), $2.25. N. L. Parker, 1240 Bedford, Detroit 30, Mich.

SELL OR SWAP — Pfeiler sig. tracer with built-in speaker; Dynamic tube tester; 6 v. battery charger, charges up to 6 batteries; heavy-duty neon sign transformer. Want SX42 or what? Jenkins Radio Service, Doniphan, Mo.

TRADE — 1951 Philco auto radio for Chevrolet, push-button style, not custom-built; also Silvertone combination radio-phonograph, etc. Want camera, TV, or what have you? M. Gianfrocco, 1 Bell St., Providence 9, R. I.

SELL OR SWAP — Buccaneer 35 mm. camera, coated f3.5 lens, shutter speed 1/10-1/300, rangefinder viewfinder combined, flash attachment, leather case, extinction exposure meter, l. n., $50 or swap for Heathkit sweep gen., TS-3. Edward Kielar, 1051 West 21st St., Lorain, Ohio.

WANT — CQ 1946 and prior, QST 1930 and prior. Must be reasonable. C. Storch, 5 Winfield Terr., Great Neck, N. Y.

FOR SALE — Heathkit 0-9 scope and demodulation probe, exc. cond., $45. Bill Granata, 382 DeKalb Ave., Brooklyn 5, N. Y.

WANTED — Employment as TV troubleshooter and antenna installer. Frank H. Brinkman, 4607 Natural Bridge Ave., St. Louis 15, Mo.

FOR SALE — Precision 920-P tube and set tester, Eico multi-signal-tracer, Stancor battery eliminator; also radio and TV tubes and parts. Oliver Pinkerton, 376 East Ohio Ave., Sebring, Ohio.

FOR SALE — Complete radio-TV course, including assembled 2" scope, sig. gen., meter, 17" TV. Best offer. J. Nowak, 60 Zelmer St., Buffalo 11, N. Y.

WANTED — Motorola auto radios. State cond. and price. Auto Radio Specialists, 4015 MacArthur Blvd., Oakland 19, Calif.

SWAP OR SELL — Pair 110 AC 6G selsyns. Need BC-221, Gonset Tri-band or what have you? A. Taddeo, Water St., North Pembroke, Mass.

FOR SALE — Sams Photofacts, 1 to 100, exc. cond., $75. MacRabie's Radio Shop, Walton Road, Franklin, N. Y.

WANTED — Constant voltage transformer for TV such as Sola Type CVA 7202. Give full details and asking price. James Littig, Kasota, Minn.

SELL OR TRADE — National NC100 rcvr., all new condensers and resistors, overhauled completely, $50 or 1951 Chevrolet auto radio, must be custom, 2 piece radio. Forrest E. Shanks, 2416 Ralston Lane, Redondo Beach, Calif.

WANTED — Outdoor Radio Service sign; RCA 45 RPM player; trade school appliance course; all reasonably priced. John Uscin, 15 Myrtle St., Yonkers, N. Y.

FOR SALE — SX-62 Hallicrafters receiver with R46-10" speaker, used only three months. Any offer over $250. Bill Watson, 9601 133rd Ave., Ozone Park 17, N. Y.

FOR SALE — VM triomatic record changer, good cond.; ICA code course record set, 78 RPM, 2 to 15 wpm, l. n.; plus 70 issues CQ (1945-1951), write for list. Theodore C. Sprouse, Timber Lake, S. D.

WANTED — Sams Photofacts, complete or single vols.; Precision E-400 sweep gen.; Mallory 12VT1D vibrator checker 6 and 12 v. model; SX-25 receiver. State cond., price. R. A. Brown, CSC, USN, USS Pickering, DD 685, c/o FPO, New York, N. Y.

SELL OR TRADE — Pair Handi-Talkies BC-611 (3-4 Mc.), $100; Eico 7" scope, l. n., $90 plus shipping; Westinghouse 6J6's $1 ea., 10 or more 75 cents; tubes: 807W, 811, 813, 832, etc. J. Snow, Box 376, Eldorado, Okla.

SELL OR TRADE — Lionel freight train, complete with switch, transformer, automatic uncouplers, exc. cond., for communications receiver or sell for $70. Stephen Kimbleton, 317 Taylor Drive, Lexington, Ky.

FOR SALE — Time delay relays, complete with coin slot, $2. McKay Radio, 4015 MacArthur Blvd., Oakland 19, Calif.

FOR SALE — Instructograph code machine, 15 tapes, AC operated; Triplett NRI volt-ohm-mil-ammeter, model 44, 10,000 ohms DC, 2000 AC, leads and manuals; CA-11 signal tracer. All in good cond. Best offer over $50 takes all 3, FOB. R. C. Hequet, 795 North 10th Ave., Kankakee, Ill.

FOR SALE — 30 UTC transformers, A-10, any reasonable offer accepted. A. Sylvane, 302 Oakland St., Brooklyn 22, N. Y.

FOR SALE — Pilot FM tuner, model T601, very good cond., $15; GE 1201D 12" speaker 14½ oz. magnet, never used, $10. Jerry Dewey, 328 Grand Street, Allegan, Mich.

WANTED — Bargains in electronic equip. for cash, must be in good cond., and priced right. Urgently want test gear, transmitters, search radar (range up to 30 miles), etc. Send full details. Herbert Piller, 749 Beck St., Bronx 55, N. Y.

WANTED — Two tape recorder movements, 7½" ps, complete, without amp., first class cond. necessary. E. Muelier, 44 Carlton St., East Orange, N. J.

FOR SALE — TR-4 transceiver $15, SA403A speech clipper $8, Gonset clipper noise limiter $6, Gonset 10-11 converter $15, 0-6 scope $25, two 4-125a slightly used $15 each. W. L. Lamb, Box 88, Warren, Minn.

WANTED — Geiger counter, test equip., electronic parts. State lowest price. G. E. Stowers, 2020 East 48th Terr., Kansas City 30, Mo.

SELL OR SWAP — Electronic Measurements Co. AM-RF sig. gen., model 500; Riders TV vols. 6 and 9; Philco TV yearbook, 1950. All like new. Want 6 v. battery eliminator, typewriter. L. Miller, 417 Wagner, Washington, Ill.

SWAP — NRI communications course with assembled kits for radio-TV receiving tubes. Make offer. Pat Blaney, New Straitsville, Ohio.

FOR SALE — Heathkit VTVM model V6, perf. cond., $25, complete with instruction manual. M. L. Chapin, 11684 Coyle, Detroit 27, Mich.

FOR SALE — Heavy-duty prop pitch motor, $14; RCA Radiola-33 model AR-784, RCA 100A speaker, in operating cond., make offer; power supply 3500 v. AC C.T., 400 Ma. DC C.C.S., $50. H. E. Wood, 451 Manor Rd., Hatboro, Pa.

WANTED — Riders and Sams manuals. Will pay cash. C. H. Sorrels, 1901 No. 7th St., Waco, Texas.

SWAP — Model 600 Regency UHF converter, for small discarded radio or TV sets. E. Bridges, 217 Lineberger St., Shelby, N. C.

SELL OR TRADE — Eico volt-ohm meter model 221, $4; Eico tube tester, model 625, $34; Weston tube tester model 682, $18; Emerson portable record cutter with amplifier playback model 529-9, $49, mike included. Want Pentron tape recorder. A. Hanjian, 102 Floral St., Roselle, N. J.

SELL OR TRADE — Philco VTVM; Eico: scope, sweep gen., model 315 sig. gen., cap bridge; 1RC resistor cabinet, tubes. Trade for anything, quitting business. E. A. DeCobert, 609 Henrietta Street, Gillespie, Ill.

TRADE — Finest **new** fishing tackle, Rolgide rods, etc., for factory built TV alignment equip.; also want sweep gen. and scope. Norm Begg, 2615 West Coast Highway, Newport Beach, Calif.

WANTED — Portable lab type meters, any cond. State make, cond., price. M. Vogel, 531 Thatford Ave., Brooklyn 12, N. Y.

FOR SALE — Heath preamplifier WA-P2, perf. cond., $15; Heath FM tuner, FM-2, exc. cond., $15. N. Kulke, 19620 Pasnow Ave., Euclid 19, Ohio.

WANTED — Commercial receiver 4 bands, have new 16 mm. film reels and cans, plus Conn B flat tenor sax in exc. cond. to trade. G. D. Griffin, 4644 Geary Blvd., San Francisco 18, Calif.

FOR SALE — 5 Taylor 810 tubes, $2.50 each, all for $8; 2 HY75A tubes, $3 both for $5; 4 GE Pyranol 67X32 28 mfd @ 1500 v. DC; condensers, meters, etc. Write for list. B. A. Winterkorn, 175 Lake St., Waltham 54, Mass.

WANTED — Ferris AM gen., model 22A or 22D. S. Toufexis, 51-28 Reeder St., Elmhurst 73, L. I., N. Y.

FOR SALE — All Heath kits with instruction manuals, used very little, exc. cond.; 09 scope (5UP1) $55; V6 VTVM $20; DC1 decade capacitor $14. Joseph F. Dineen, 9 Winter Terr., Westwood, Mass.

WANTED — Cycloid fishing reel. Will trade electronic equip. or pay cash if in fair to good cond. Sidney Miller, Jr., 1669 Newbern Rd., Kingsport, Tenn.

WANTED — RCA Demonstrator Boards No. 3. Buffalo Radio Institute of the YMCA, 45 West Mohawk St., Buffalo 2, N. Y.

SELL OR TRADE — Collins model 45D FM and AM deluxe 19-tube tuner with 7 control knobs, with input for GE pickup, good working cond., $100, or Browning RJ20-B or better tuner or high class 15" speaker. R. C. Robinson, 1814 Robin Rd., North Augusta, S. C.

FOR SALE — ARC-5 receivers 1.5-3, 3-6, 6-9.1 Mc, complete with local control adapter, rack, 24 v. DC 2 amp power supply, dynamotor, phones, instruction manual, good cond., $35. Local only. Wallace Kurtz, 1840 East 36th Street, Brooklyn, N. Y.

FOR SALE — 6 volt Atlas Quick battery charger, $35 FOB. F. G. Caswell, 4018 8th St. Place, Des Moines, Iowa.

WANTED TO BUY — Hammond chord organ or other standard electronic organ. Must be in good cond., and priced right for cash. M. W. Driskell, 407 Lauderdale St., Selma, Ala.

WANTED — Zenith transoceanic portables and AM-FM table radios. Advise model, price and cond. Mercury Radio Service, 433 South Wabash Ave., Chicago 5, Ill.

FOR SALE — Esterline-Angus graphic ammeter 0-5 milliamperes, spring chart drive 12 inches/hour, to 3/4 inch/day, extra charts, ink, etc., $125, cash only. Richard S. Shultz, 9714 Montauk Ave., Bethesda 14, Md.

FOR SALE — Mallory TV-101 UHF converter, used 5 hrs., highest offer. K. S. Ferrin, 485 So. Main, Miamisburg, Ohio.

WANTED — Cornell-Dubilier, Mallory, and Philco parts catalogs older than 1940; will also buy certain old controls. Standard Radio, Hamilton, Ohio.

SELL OR SWAP — Complete QST's 1927-1952; 75 copies CQ; many ham items. Want Heath square and sine osc. Bob Schill, 1400 Paulson St., Wantagh, L. I. N. Y.

FOR SALE — Eico 221 VTVM, Supreme 563 variable audio osc., back issues of Proc. of IRE, to 1947, of Electronics to 1938. Best cash offer. J. Bernstein, 67-36 214th St., Bayside 64, N. Y.

WANTED DESPERATELY — Diagram and/or technical information on old model National HRO receiver, model number unknown, uses tubes 2A5, 2B7, three type 57 and three type 58. Thomas Korn, 3246 North Orange Ave., Chicago 34, Ill.

FOR SALE — Indicator BC-929-A, can be converted to Precision 3" scope. The 400 cycle power transformer removed, included is perf. RCA scope power transformer and conversion instructions, $15. B. H. Mosbacher, 515 Indian Terr., Rockford, Ill.

FOR SALE — Feiler "5" scope, model TS-7, with probe $25; Videolo 10" TV slave set in mahogany cabinet, $40. W. R. Batten, 1536 Crosby St., Rockford, Ill.

WANTED — Mobile Xmtr. to cover 75 meters, plate modulation. Prefer commercial unit, good cond., have Xmtg. tubes and parts, receiving parts and connectors for sale or partial trade. What do you need? Bill Benner, 930 Huron River Dr., Belleville, Mich.

FOR SALE — Receivers: NC125, 1. n., AR88D exc. cond., BC312 converted; also BC458 Xmtr. and dynamotor from 19 set MK III. Reasonable. J. T. Somerville, Kearney, Ontario, Canada.

SELL OR TRADE — Unused Leica III CF2 Summitar lens for 15" Hi-Fi spkr., with enclosure, or new Hi-Fi amplier with preamp. Prefer Macintosh amplier with Altec Lansing spkr., or $150. Thomas G. Ravesi, 99 Rockridge Rd., Waltham 54, Mass.

SELL — Columbia Microgroove phono; Brush PL-20 transcription pickup, equalizer; Astatic FLC-33 microgroove pickup, filter; Speco 3-mike mixer; pair Intertalk telephones; Sperti portable sunlamp. Each item $7.50 and FOB. M. L. Phillips, 311 Penfield, Rockford, Ill.

SWAP — Sporting rifles, photo equip., for radio test equip. Osborne Photo Service, Box 177, Newland, N. C.

SWAP — NRI Servicing course or NRI Code Sender, with 6 code tapes and lessons. Want small hand printing press. T. C. Coughlin, 441 42nd St., Brooklyn 32, N. Y.

SELL OR TRADE — PE-103-A dynamotor in exc. cond., for tape recorder and small screen TV. Need not be in operating cond. if died natural death. Richard Bell, 5256 Philip St., Bedford, Ohio.

FOR SALE — Riders TV manuals 2 to 7; DuMont 7EP4; Motorola 7" TV, all in very good cond. TV set has intermittent pix tube. Edward F. Ciuba, 409 Harvard Ave., Hillside 5, N. J.

WANTED — "How to Service Radios with an Oscilloscope," and "Servicing Radio and Television with a Vacuum Tube Voltmeter," by Sylvania. Roy A. Throckmorton, 268½ Carroll St., Akron 4, Ohio.

FOR SALE — Riders 6 thru 15, Sams 1 thru 243, bound. Covers 1932 to date, $300; Hickok 670 scope $165; VTVM 209A with PR30KVA probe $95; 533DM counter tube checker with CRT-1 adapter $90. Thomas E. Hardy, Box 84, Hardy, Ark.

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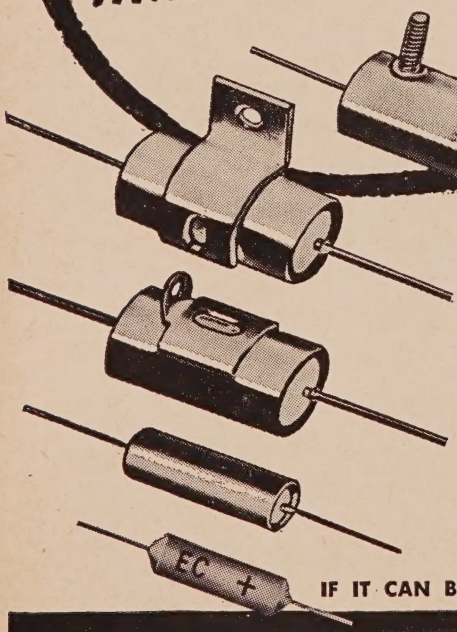

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